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THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

Publishing Office, No. 42 Pine Street.

Devoted to the Interests of Illumination, Heating, Ventilation and Sanitary Improvement, Domestic Economy, and General Science.

VOLUME XX.—No. 8. Whole No. 356. | NEW YORK, THURSDAY, APRIL 16, 1874. | $3 PER ANNUM IN ADVANCE.

[Original Communication.]

An Examination of Lignite:

FROM DISKO ISLAND, ON THE WEST COAST OF GREENLAND.

[By Professor Henry Wurtz.]

This material (samples of which I owe to Professor D. S. Martin, of New York) is black in the mass—powder brownish—shrinks and becomes full of fissures in dry air—is composed of a mixture of a dull mineral charcoal, and a resinoid lustrous material, having much the aspect of the lustrous component of caking coals, but less brilliant. These two ingredients are irregularly interlaminated. My sample contained one resinous granule—size of a wheat-grain—amber colored and transparent, which, when heated, fused and then gave off a clear yellow oil with an odor like oil of amber.

After drying in small fragments for some days in a dry winter atmosphere, it was operated on according to the customary mode of "crucible analysis" for coals, and yielded

Water		14.00
Volatile matter		35.38
Coke: containing	Carbon	41.79
	Ash	8.83
		100.00

During the expulsion of the volatile portion, the flame was pale yellow, without smoke or soot. This would apparently indicate but little candle-power for the gas; but it is not conclusive, as the steam given off must greatly modify the flame. If the above proportion of volatile matter still holds, in the *dehydrated* lignite, the latter would equal, in this respect, a rich gas-coal, having over 41 per cent. of volatile matter. This point would be worthy of settlement, in view of the value of a gas-coal in these dark latitudes. The amount of my sample was much too small to admit of any experiments in gas making.

This water requires for its expulsion from the mineral, but a sand-bath heat: and, when it has been expelled, I have found that the powder of the mineral acquires a somewhat *pyrophoric* quality, taking fire when heated, much below a red heat.

THE COKE AND ASH.

During the coking of this lignite, in small fragments, it shrinks *without change of form*, at least 40 per cent.; and the coke contains portions greatly resembling anthracite. This proves that a powerful and valuable fuel may be obtained by coking. Sulphur was present in this coke, to a small but undetermined extent. The little masses of ash left by the complete combustion of the fragments, were variegated in color, some having a curious *greenish* tinge, which was supposed to be attributable to manganese; but blowpipe tests made since have failed to detect that metal. This ash contains some lime (with very little magnesia) though it does not effervesce with acids, and is neutral to test-papers. There is also some iron, and the ash melts before the blowpipe to a dark glass; indicating that this fuel is liable to clinker and be destructive to grate-bars.

This lignite—which is proved, as I am informed, to be of Miocene Tertiary age—comes close, in the results of its "crucible analysis," to the Cretaceous lignites of Mount Diablo in California, Prof. Whitney gives (Geology of California, 1865, page 30) for the mean of five varieties.

	Mount Diablo	Disko.
Water	15.53	14.00
Volatile	37.50	35.38
Fixed Carbon	42.66	41.79
Ash	4.50	8.83
	100.00	100.00

If the ash—which is a very variable constituent—be eliminated in each case, the centesimal composition approaches still closer.

	Mount Diablo. J. D. Whitney.	Disko Island. H. Wurtz.
Water	16.23	15.36
Volatile matter	39.18	38.81
Fixed Carbon	44.58	45.83
	100.00	100.00

DENSITY.

One of the most remarkable results obtained by me with this mineral, is its very high density. Two determinations, made upon small fragments, by the stoppered-bottle method, gave 1.452 and 1.468, in the mean 1.46. The highest density-figures for lignites, that I have encountered, are 1.354, for one from Colorado—containing 13.67 water and 4 per cent ash (J. T. Hodge)—and 1.364 for an Austrian kind containing 12.54 ash (Dana's Mineralogy, 758). The great shrinkage while coking led me to determine, with great interest and care, the density of the coke. It was found, when wetted with water, to *effervesce* strongly, evolving a considerable volume of (oxygen?) gas. I was obliged to boil it with the water for half an hour before it ceased to emit bubbles. Its true density was then found to be as high as 1.836! This is higher than any anthracite I have found on record so far, those of Pennsylvania not ranging higher, except when very ashy, than 1.6, and the heaviest—the Rhode Island—being but 1.8. It is to be remembered, however, that the coke of the Greenland must contain some 17 per cent of ash. On the supposition that this ash has a density of 2.5, the calculated density of the 83 per cent. of pure carbonaceous matter of the coke is still as bigh as 1.7. I am unable to say what the density is of the coke made from Colorado lignites, nor indeed whether the densities have been determined of any cokes whatever.

LABORATORY: 12 HUDSON TERRACE,
HOBOKEN, April 1, 1874.

Mica-Substitute for Stoves.

Dr. A. A. Hayes communicates to the *Scientific American* as follows:

The want of durability in mica and the difficulty in bending it renders the application of another material desirable. My observations have convinced me that we have the most desirable qualities in thin glass tubes, so arranged as to present an even and nearly airtight surface. As glass tubes are drawn at the glass houses, they are slightly though perceptibly conical, a matter of no moment, as by alternating the larger and smaller openings, when they are laid parallel, close joints result.

Three kinds of glass are met with in the market Brown bottle, greenish lime, and cullet and flint glass, more or less perfect. Either of these kinds may be used, as radiant heat from the fire will anneal them; flint glass, being the most pliant, is best adapted to the nicer purposes. Tubes drawn quite thin, from one eighth to one third of an inch bore, may be used, always with reference to the thickness of the envelope of which they form a part. They may be arranged side by side, either vertically or horizontally, to fill any size or space, resting loosely in a recessed space or in a clip of malleable metal to support them and exclude dust. Combinations of shorter and longer tubes may be used for paneling or otherwise varying the surface. But ornamentation will doubtless be best gained through colored and particolored tubes, so arranged as to produce the most pleasing variety. It is well known that silvering within the colorless or colored tubes can be easily so adjusted that much light will be transmitted, while on another part the lustre of burnished metal may be obtained, while little light is lost.

Sliding, folding, and curved screens of any size, flexible or fixed, can be formed with these tubes, so that stoves with open or closed fronts may be made. There is not the slightest risk of fracture of the tubes, excepting from a blow or similar accident; and any partial destruction can be repaired by substitution in a few minutes' time; indeed, the pliancy of the structural forms of a large size is a safeguard. Washing or other cleansing of the surfaces can be done without danger when the glass is cool.

The increased consumption of glass in this way will diminish its cost in the form of small tubes, and lead to the introduction of ornamental and beautiful designs in all appliances for warming apartments by visible fires.

Chemical Repertory.

No. 109.—April 16, 1874.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

1075. Not Quite Unfathomable.—By the soundings of John McKinney, an experienced navigator and old resident in the vicinity of Lake Tahoe, Cal., the greatost depth of that remarkable body of water is found to be 1,646 feet.

1076. Cheap Constant Voltaic Battery.—Pierlot has described to the Academy of Sciences a battery made as follows: He places about a pound of chloride of lead at the bottom of a glass or porcelain vessel; then bury in it a plate of lead fixed to a wire of the same metal, and insulated by means of varnish: and next a plate of amalgamated zinc, wrapped in dialysing paper; water must be added every two or three months; the current produced by this battery is described as being at once energetic and constant. —*London Mining Journal.*

1077. Petroleum in Burmah.—Captain Storer, agent for the British Government, reports that there are at present about 150 wells worked at Yegnangyoung, which yield 62,500 barrels of oil a year. At Pagan there are about fifty wells. The oil from these wells is obtained in a more liquid state, and more resembles naphtha. It is of a brackish nature, and is better suited for lighting purposes than the Yegnangyoung oil.

1078. New Use of Gas.—Mr. Baker, Inspector of of Factories, notices in his report, recently issued, that gas-engines are coming into use in various trades, particularly for small letter-press printers and ribbon weavers. It is a cheap and easily applied motive power, whenever a solid foundation for the engine can be obtained. In the neighborhood of Coventry, he observes, steam-power forming a considerable element of expense in the weaving of ribands, the gas-engine has been applied to do the work of boys of 13 or 14 years of age, who used to turn the machinery, and the invention is acceptable, as relieving labor of some part of its fatigue.—*Iron.*

1079. Coal-Ashes in Agriculture.—The New York *Tribune*, which, ever since the death of its famous founder, tries still to "know about farming," says that

* * * "On the basis of numerous analyses of many varieties of coal from different localities, it is again asserted that coal ashes exert a beneficial effect on land, not only by reason of their mechanical action on some soils, but also on account of their mineral ingredients; a ton of ashes containing about thirty-three pounds phosphoric acid, beside sulphate of potash and alkali."

In this, as in all human affairs, the "proof of the pudding" is all in all. We owe to Professor F. H. Storer of Boston, Prosessor of Chemistry in the New Bussey Institute, or School of Agriculture, a *practical* series of tests on plant-growth, from which it appears that anthracite-ashes, at least, have no greater general activity, as a chemical fertilizer, than ordinary building-sand, from glacial-drift, near Boston.

1080. American Glass-Working.—American glass, it would seem, like many other great staple products of our "young giant" country, is looking up. The writer may state, that having had late occasion to buy glass-stoppered bottles, on testing a considerable collection of French, German, and American lots, the latter, while about half the price of the others, were found decidedly superior in the perfection of grinding of the stoppers, some sizes being indeed *perfect*. The fame of our glass goes abroad, and we get the following item from an English source:

"A very delicate piece of work was accomplished at the South Wheeling, Ohio, Glass Works, a short time ago. Several scihntific gentlemen desired a glass tube for experimenting in acoustics. A tube was blown thirteen feet in length and two and a half inches in diameter, with not even an air bubble to mar its snrface. The glass is not thicker than common window-glass."

1081. Coal-Tar Pitch Patent.—Tobias New, of New York, believes he has benefitted his race as follows:

"This invention relates to the residuum of coal tar, now used for roofing, paving, and vault covers. As soon as sufficiently cool, this residuum is placed usually in barrels, wherein it soon solidifies, and from which it can only be removed by their destruction, while the cooling and reheating impair its quality. The present invention is a tank in which this valuable cement may be offered to the trade with all its original qualities, and without any necessity for the destruction of the package that contains it. The tank or metallic barrel is made air-tight, to prevent the evaporation of the valuable adhesive properties of the cement, and, in conjunction with the inner lining, which is a non-conductor of heat, to prevent the escape of caloric. The asphaltic cement is drawn from the still into these barrels or packages, which are then transferred to a chamber, kept always at a suitable temperature, and there held in readiness to be supplied to the trade. During transportation from one locality to another, a small fire is maintained in a central furnace, but only sufficient to make up for the heat that will very slowly escape from the air-tight and heat-protected package."

1082. The Unhealthfulness of Furnaces.—A doctor writes to the *Christian Union* in wholesale condemnation of hot air furnaces. He aiserts that 99 out of 100 furnaces now in use cause more or less impairment of health, and that more people die in the United States every year, from disease induced by breathing the air of furnace heated houses than die from small pox. The escape of noxious gases is the chief source of unhealthfulness. Most furnaces are made of cast iron, through which these gases readily pass, and if made of wrought iron the great number of joints necessary in the construction renders leakage almost certain. Besides this, there is another evil which is inseparable from this mode of heating houses, and is sufficient alone to justify its abandonment. In a house thus heated the inmates are constantly bathed in a current of warm or hot air. Instead of receiving heat in direct rays as they are radiated from their source, or reflected from surrounding objects, the occupants of such a house are warmed by being submerged in a bath of heated air, and the effect is not greatly different from that of prolonged submersion in warm water. Every one knows what the effect of this is; it produces relaxation of the tissues and general debility.

1083. Effectiveness of Air-Vessels.—It is well known that the air in the air-vessels of pressure-pumps or water-rams sometimes is absorbed by the water, in which case they become useless to fulfil their function in equalizing the intermittent action of the pumps, by the elasticity of the entrapped air. This matter is so important that a patent, No. 57,412, was granted August 21st, 1866, to Dr. Van der Weyde for a device to secure a supply of air in the same. Professor F. E. Sweet now, however. suggests a remedy, wherewith any such device may be dispensed with; he simply recommends to place in the air-vessel some sperm oil, which floating on the top of the water forms a film which prevents its contact with the air, and herefore its absorption. Trials on a small scale have verified the usefulness of this precaution, which, therefore, ought to be applied to all such air-vessels. Heavy lubricating petroleum, if not better, must be at least as good as sperm oil for this purpose.—*Manufacturer and Builder.*

1084. Aluminum for Small Coin.—Apropos to a project for remodelling the coinage of Germany, Dr. Clement Winkler has published an essay in which he strongly recommends the use of aluminum as the best metal for small coins. After giving an elaborate history of the fabrication of aluminum, the author seeks to prove that the properties of this metal are exactly those required for coinage. The density of the metal is about three and one half times less than that of the alloy of copper and silver now in use. Dr. Winkler recommends that small coins of pure aluminum be struck off, and observes that an alloy of silver and aluminum might advantageyusly be substituted for the alloy of silver and copper now used for large coins. He thinks that the metal is susceptible of more numerous applications than have yet been made.—*Scientific Press.*

1085. Nitrite of Ammonia.—M. Berthelot has recently succeeded in producing this body for the first time in a crystalline state. Nitrite of baryta is placed in sulphate of ammonia. The precipitated sulphate of baryta is collected on a filter, leaving the nitrite of ammonia in solution in the liquid. The crystalization of the latter cannot be obtained by heat, as the same causes a rapid decomposition of the substance; hence the liquid is placed under the receiver of an air pump, with very hygroscopic materials. In spite of these precautions, however, and although the operation is conducted at the freezing temperature, about two-thirds of the product become decomposed. The balance, however, is pure nitrite of ammonia, crystalized in white needles. The bady is remarkable for its explosive properties, detonating violently at 165·2° Fah., or by reason of a shock, with a force nearly equal to that of nitro-glycerine.

1088. Liquefaction of Gases.—A piece of fresh wood charcoal is placed in a strong U tube, like that first employed by Faraday for condensing gases, and saturated with dry chlorine; the two ends of the tube are then sealed with a blowpipe. By heating the longer end of the tube which contains the charcoal in a boiling salt-water bath, and plunging the shorter limb in a freezing mixture, a considerable quantity of chlorine will be driven out of the charcoal, and condensed by its own pressure in the cold portion of the tubes. Melsens says that he has obtained in this way several cubic centimeters of pure liquid chlorine. On taking the tube out of the salt water bath, the liquid chlorine begins to boil spontaneously, and is again absorbed by the charcoal. while the short end of the tube becomes covered with frost. This succession of phenomena may be repeated an indefinite number of times. Melsens has succeeded in liquefying, in the same manner, ammonia gas, sulphurous acid, sulphuretted hydrogen, hydrobromic acid, chloride of ethyle, and cyanogen.—*Journal of Applied Chemistry.*

1087. Fires at Sea.—A suggestion of Dr, Schuppert, of New Orleans, for the purpose of extinguishing fires on shipboard, seems practical enough to warrant reproduction. According to his plan there are to be placed at given points in the hold of the vessel, boxes furnished with a supply of marble waste. Each box is to be brought into communication with the deck of the vessel by means of lead pipes, terminating in a funnel or other convenient attachment. Should a fire be discovered in the hold, sulphuric acid is poured down the pipes; and this, coming in contact with the marble, causes the active evolution of carbonic acid gas, which finds its way in quantity into the hold, through perforations in the boxes, surrounding the cargo with an atmosphere which is a non-supporter of combustion. As the carbonic acid gas is much heavier than the air, it is anticipated that it will not escape in any considerable quantity until the hold is filled to overflowing.—*Amer. Exch. and Review.*

1188. Dangers of Well-Watel.—The dangers of bad milk are engrossing so much attention just now, that there is reason to fear, lest the far greater danger of bad water should for the time be overlooked. We trust this serious error will not be committed. For one sample of dangerous milk a thousand of dangerous water could be obtained in almost any part of the country. Let it never be forgotten that very few rivers or wells are safe sources of water supply, and that as many are unsafe as loaded fire-arms. The shallow wells of villages are among the pests of the country, and it is high time that a zealous

and well organized crusade should be brought to bear upon them. It is sickening in most country places to observe the uniformity with which the cesspool and well are made to stand side by side, as though each was necessary for the other; and to think of the 20 feet or so of foul, sewage-reeking soil through which the water percolates to its fetid bed! The question shou'd engage the attention of every health officer, and will, in too many cases, tax his energies severely, for it is one of the hardest sanitary problems. It is always possible to provide a city or town with good water, but in a village, where houses are few, money scarce, and intelligence scarcer, it is a matter of exceeding difficulty.—*London Lancet.*

1089. UNINFLAMMABLE DRESSING FOR DRESSES.—Hager suggests the following formula for the preparation of a starch which shall render fabrics incombustible: At first, 50 parts of hot water are poured over 10 parts of white burned bones ground to a fine powder, and to this six parts of sulphuric acid is gradually added. The mixture is well stirred, and kept in a warm place, where it is also stirred from time to time for two days, after which 100 parts of distilled water are added, and the solution filtered. The filtrate, which contains the soluble phosphate of lime, has added to it five parts of the sulphate of magnesia, dissolved in 15 parts of distilled water. Enough ammonia is next stirred into the cold solution to give it the smell of ammonia. The precipitated double phosphate of ammonia and magnesia is collected on a linen filter, pressed and dried in a moderately warm place, and then reduced to a powder. Two parts of this powder are then mixed with one part of tungstate of soda and six parts of wheat starch. Care must be taken that no iron enters into the materials of the manufacture. To use this powder it is mixed with twice its quantity of cold water, and then enough boiling water stirred in to form a slimy liquid, in which the goods to be protected are immersed.—*Am. Exchange and Review.*

[Original Communication.]

Some Notes on the Chemistry of Gas Manufacture.

BY AUGUSTUS A. HAYES.

[Continued from page 56—Feb. 16.]

ANALYSES OF COALS.

The coals of which the description follows, were either taken from the beds by myself, or are known to be well characterized specimens of the deposits named. Some details are omitted in order to give prominence to other points.

In relation to the origin of coals, it will be conceded that if we had a specimen of known derivation, its characters would throw light on the chemical changes which had occurred.

The coal measures containing the coals of Nova Scotia, inclose masses, often considerable, of coals from tree and plant remains.

"*Agave*" *Coal.*—This coal preserves the delicate markings of a luxuriant plant—the *Agave Americana*, or closely allied variety. It reposed in a mould, as it were, without any vacant space, and there are no marks of contraction after the plant had passed into the humus state. Immediately in contact with it was finer material than sand, which has infiltrated step by step as the formation of humus proceeded, in the well known Nova Scotia building stone.

This finer material represented the true shales of a coal bed, and my observations have suggested that the fineness in texture and thickness of this material, bears a relation to the kind of coal inclosed. This specimen, and hundreds near it, had in connection the iron compounds, which Prof. Henry Wurtz first pointed out to have been influential in the conversion of humus to true coal—a fact my own observations confirm.

The Agave species contains abundance of fibrous cellulose, and a complex lignose or incrusting matter. We have therefore a humus, resulting from compact woody matter, surrounded by amylaceous and dextrine-like bodies, and salts of alkalies and calcic and magnesian bases. The inclosing rock is sand, cemented to the rock state by a cement of well known composition.

This coal is black, with shining lustre, close texture; breaks into rectangular fragments; structure lamellar, few rents. Assay sample had been cleansed and dried at 72° Fahr.

Tested in the tube the condensed water was acid, above 600° Fahr. and offensive odor, vapor not inflammable, oily body like petroleum, sulphur compounds, anthracene-like body and white sublimate; coke compact, no expansion. 100 grains decomposed afforded

	Slowly Heated. Grains.	Rapidly Heated. Grains.	Sudden Heat. Grains.
Water, acid, 450° to 480° F.	6.75	6.82	6.82
Oily matter and gas, "	16.00	17.68	17.86
Fixed carbon "	75.32	73.57	73.39
Ash, 480° F.....	1.93	1.93	1.93
	100.00	100.00	100.00

Coke in every trial was like anthracite after ignition, ash brownish red.

Coal from Jackson county, Ohio: Color, black, lustre, dull, slaty, divides into blocks. The whole mass made up of pressed folia and flattened stems of plants; markings preserved and thin coverings of calcic salts; resembled Cannel. 100 grains decomposed afforded

	Grains.	Grains.	Grains.
Water, 450° to 480° Fahr....	1.80	1.95	1.05
Oils and gas " "	43.70	47.55	47.80
Fixed carbon " "	42.50	38.50	38.25
Ash " "	12.00	12.10	12.00
	100.00	100.00	100.00

Coke matted; volume hardly increased; brilliant compact; ash light gray with yellowish tint.

Coal from Dudley Coal Field, England.—Color black, lustrous, laminated, with included layers of mineral charcoal. Gave no color to caustic alkalis. In the tube gave vapor of water at 400° Fahr. At 800° Fahr. began to decompose, emitted a peculiar odor, followed by smoky gas and water, resembling the odor from brown coal.

ASSAY SAMPLE DRIED AT 72° FAHR.

	S. Heated.	R. Heated.
100 grains afforded water.....	3.08	5.50
Volatile oily matter and gas.....	17.50	19.50
Fixed carbon.....	72.30	67.90
Light gray ash.....	7.20	7.10
	100.00	100.00

Coke resembled laminated anthracite; ash light gray colored. This coal cannot be coked by the heat of its own gas and vapor. When coked with other coal, masses of perfect anthracite can be selected; in other cases the composite character may be seen in the coke.

Lignite from Brandon, Vt.—The sample was part of a large tree, all the markings and vessels preserved; color reddish brown. Mr. J. H. Blake found that compact fragments of this lignite, recently removed from the tertiary clay, gained oxygen, while losing moisture. I confirmed this result. The sample may be regarded as a type of the species; the result here given, a *resume* of many trials.

One hundred grains after drying at 72° Fahr., heated to 212° in nearly closed tube, lost moisture, 16.26; 2 hrs. exposure, 16.51; at 300° Fahr., 18.75; at 400° Fahr. became constant, 20.50. After exposure to air at 72° Fahr. 12 hrs. the dried assay became 6.75 heavier.

In the retort at lowest point of charge, water containing acid from the dried assay, oil followed; at 800° Fahr. gas flowed steadily, a brown dense oil succeeded, and at full ignition a black dense coke, of the form and size of the assay remained. One hundred grains afforded

Combined water, lost at 400° Fahr.....	20.50
Water, oils and gas, lost at 400° Fah.....	33.87
Fixed carbon, lost at 400° Fahr.....	41.87
Ash, lost at 400° Fah.....	3.76
	100.00

The ash was nearly white, and retained some forms of the vessel structure; water on the ash was permanently alkaline, from silicates of alkalies.

In this instance we have the most perfect kind of woody fibre decomposed, in a closely investing clay under the most favorable conditions for forming true coal, from which the result differs most remarkably.

Instead of taking space for the results of numerous analyses of German, Austrian, American, and Arctic Brown Coals, I will here state that many of them can be referred to the *humus of forests*, decayed leaves, seeds, pollen and wood of trees and shrubs, resulting from varieties in the order of succession, due to *natural rotation of crops*, on the same clean surface of land. My friend Prof. Hind, found on the Red River of the North, a remarkable deposit of light brown, coal-like body, at first perplexing, but finally referred to the buffalo droppings, transported and deposited in mass!

The Arctic brown coals often contain amber-like resins, mottling the black color and the Austrian beds afford brilliant, compact coal, like Albertite, though differing in composition. These examples are offered as showing that variety in the humus produces variety in the resulting coal, under like conditions.

In turning to those coals which are remarkable for producing large proportions of oil in one mode of decomposition and large volumes of rich gas under other treatment, I shall regard Albert coal or Albertite, as the typical variety; Boghead and Cannelite as closely associated—both affording worthless coke—inasmuch as these three substances differ from Cannels, in producing no benzole in the gas manufacture. The etherial oils from these coals are congeners of benzole, but they offer the important character of not crystallizing at a freezing temperature, but at a lower point maintaining vapor of elastic force sufficient to confer on the gas the character of permanency desirable everywhere, especially in cold climates.

[To be concluded.[

Trade Circular.

FROM BIRD, PERKINS & JOB.

(Received March 28, 1874.)

SALES OF GAS COALS IN NEW YORK.

During the past two weeks, the New York Gas Companies have made contracts for their supplies of coal for the current year. These transactions involve the delivery of from 350,000 to 400,000 tons of coal in this market, and the prices made therefor govern to a great extent the cost of gas coals in other markets.

The fact that the gas companies in this city and vicinity have in store full six months supply, has led to a reduction in the price from that paid one year since. The sales just made include say—

300,000 Tons Westmoreland and Penn Coals @ $7.50.
25,000 " West Virginia Coals ..... @ 7.50
22,000 " Cannelton Cannel..... @ 12.50

all 2240 lbs. delivered at the wharf in New York.

There have also been some orders for the Youghiogheny coals, which may come into the market to a limited extent; the low price of the coals quoted above prevents any extensive operations in other American gas coals. In addition to the above, contracts have been made with the Caledonia and Block House Coal Companies for about 30,000 tons of coal, at from $2 @ $2.12½ gold per ton, f. o. b. at the mines in Cape Breton. This quantity is only about one-fourth of that imported from Cape Breton in 1873, a large proportion of the quantity then received being on hand. Freights from Cape Breton have opened at $3.25 for New York, and for the small quantity required, will not be likely to increase during the year. We quote the following prices for gas coals:

Westmoreland, $6.25, at Philadelphia.
" $7.00, at South Amboy.
" $7.65, at New York.
" $8.00, ports on the Hudson.
Cannelton Cannel, $11.00, at Richmond.
Youghiogheny, $7.50, at Few York.
" $6.00, at Baltimore.
Caledonia, $2 gold, f. o. b. at Port Caledonia, C. B.
Block House, $2 12, gold, f. o. b., Cow Bay, C. B.
Red Bank Cannel, $8.50 cy., at Philadelphia.
" " " $9 cy., at South Amboy.

American Water-Gas Researches.

REPORT OF PROFESSORS SILLIMAN AND WURTZ.

[Continued from page 113, No. 7.]

NOTE ON "WOLLONGONGITE."—We have, from Professor Silliman—too late for insertion in this issue—some important documents relating to this peculiar mineral, concerning which, in last issue was given such information as was then attainable by Prof. Silliman regarding its origin, locality, etc. In our next, these documents will be given—arranged and condensed, in such form as to clear up entirely this subject, about which there has been some public misunderstanding and obscurity. It should here be added that, had it not been for protracted absence of Prof. Silliman from home, on professional affairs, we should have been in position to append these corrections regarding the *soi disant* wollongongite, in their appropriate place.—ED.

TABULAR EXHIBIT OF CLASSIFIED RESULTS.

In Table II. is an orderly arrangement of the results detailed in the last two chapters, which offers to the eye a convenient mode of comparing the effects of the hydrocarbon process with the ordinary method of gas-making, as well as the relative value of the process upon various sorts of coals and admixtures.

Columns 11 and 12 afford, on the whole, the most satisfactory term of comparison, as they show the absolute gain by the Gwynne-Harris process in total economical effects, viz.:

The product of the illuminating power into the volume of gas produced, a result from which there is no escape.

In columns 7 and 9, the numbers with an asterisk affixed show a *relative loss* in illuminating power, arising from the fact that the largely increased volume of gas produced has a less candle power *per cubic foot* than has the gas from the same coal carbonized by it large scale, by the two methods of gas making, use has been made in column 2 of the yield per ton of Westmoreland coal obtained at the New Haven Gas Works, in lines 3, 4, 5, and 6, viz.: 9,206 cubic feet, of 18 candle power, in place of 9,500, the average which belongs to gas of 16 candle power, such as is made from the unenriched Westmoreland coal by ordinary process.

COST OF MAKING GAS BY THE GWYNNE-HARRIS PROCESS.

From the data given in this report any competent gas engineer can make his own estimates of cost. Every place has its own local rates for coal, labor, materials, gas, and incidental products, so that a carefully prepared estimate for New Haven or New York, will be useful for Chicago or San Francisco only as a means of comparison.

There are, however, certain elements belonging to any calculation on this subject which it is well to consider, as also some questions which will occur to every engineer, respecting which it is best to offer such suggestions as experience and observation have brought to our notice, viz.:

First.—We are satisfied that the best and most economical results in the use of this process will, in general, be obtained by setting the anthracite retorts in the same bench, or bed, with the bituminous coal retorts. Our reasons for this opinion are, that in this way no increased cost arises for fuel, or wear and tear of apparatus; and that the gases from the anthracite retort enter the bituminous retorts hot. It adds nothing, for example, to the cost of heating a bench of retorts, either of "threes," of "fives," or "sixes," be placed in a bench by themselves, a plan by no means without its advantages, the whole fuel cost and the stoking labor, as well as the wear and tear of the whole bench, becomes a proper charge against the water-gas.

Third.—The actual consumption of anthracite coal in the anthracite retorts, burned in converting the superheated steam into mixed hydrogen and carbonic oxide gases, has been, during the four months' trial at Fair Haven, on which our calculations are based, 10,284 pounds on a make of 1,290,000 cubic feet, or computed into the gas registered, it gives 7·97 pounds for each one thousand (1,000) feet of merchantable gas introduced into the holder.† Estimating the cost of anthracite at $8 the ton of 2,240 pounds, the cost of 1,000 cubic feet of the perfected hydrocarbon gas will be about three cents for the anthracite coal required to produce it, and *pro rata* for any other price of anthracite.

Fourth.—The cost of the steam introduced into the anthracite retorts need not amount to more than the interest, and wear and tear on the boiler used to produce it, since in every gas work, of any magnitude, the waste heat of the benches is most ample to supply all the steam required. But in case the steam is drawn from the boiler connected with the exhauster, the amount of coal or coke required to produce the additional steam is easily computed, on the basis that each 1,000 cubic feet of steam consumed produces twice its own volume of mixed gases (assumed for the purpose of this calculation to be pure); therefore, if 7,000 cubic feet of water gas are thrown off in twenty four hours from an anthracite retort, one-half that bulk, or 3,500 cubic feet of steam are required: and

TABLE II.

NAME OF COAL.	Cubic feet per ton.		Illuminating power per ton, in sperm candles.		Gain by the Gwynne-Harris process.		Percentage gain by the Gwynne-Harris process.		Total economical effect, stated in pounds of sperm to ton of coal.		Gwynne Harris process.	
	By old process.	By new process.	By old process.	By new process.	Gas, in cubic feet.	Illuminat'g power in sprm c'd'ls	Quantity of gas.	Illuminat'g power.	Old process.	New process.	Gain in economical effect.	Percentage gain or loss in lbs. of sperm.
Westmoreland (alone)	9,500	14 057	16.62	16.65	4,557	.07*	48.73	.43*	541.257	797.634	256.377	40.79
Westmoreland and 5 per cent. Rosin	9,206	12 454.4	18	19.67	3,248.4	1.67	35.28	9.27	568	840.20	272.20	47.92
Westmoreland and 10 per cent. Rosin	9,206	13 753	18	21.16	4,547	3.05	49.28	17	568	997.8	429.8	75.49
Westmorsland and 10 per cent. Albertite	9,206	14 201.6	18	20.72	4,995	2.72	54.32	15.66	568	1086.96	440.96	77.632
Average results uncorrected	9,206	13 798	18	16.63	4,592	1.37	49.88	8 26	568	786.745	200.75	38.51
Average results corrected	9,206	13 171	18	20.35	3,865	2.35	41.99	13	568	917.54	349.54	61.71
Blockhouse N. S.	9,500	12 589	17.07	14.08	3,089	3.02*	31.46	21.25*	458.74	607.72	148.98	32.47
Blockhouse and 10 per cent. albertite	9,500	12 656	17.07	15.75	3,156	1.32*	33.22	8.4*	513	683.42	170	33.22
Albert coal, N. B.	14,784	28 672	49.56	24.79	13,868	24.77*	93.80	49.99*	2511.57	2436.95	74.62*	2.9*
Boghead	13,619	25 825	26.45	26.78	12,206	.33	90	1.24	1235.05	2549.56	1314.51	106.35
Peytona, West Va.	10,000	22 400	42	23.25	12,400	18.75*	124	47.10*	1440	1785.6	345.6	24
Wollongong Cannel	13,716	.....	132.94	.....	.....	.....	.....	.....	6251.26	.....	.....	.....
1	2	3	4	5	6	7	8	9	10	11	12	13

self. But when the total economical effect is computed by calculating the illuminating power and the bulk of gas combined, the real gain is seen in its proper proportions. The Albert coal of New Brunswick is thus seen to be the only one of all the enriching materials employed on which there is an actual loss (2·9 per cent.). But between the Westmoreland coal with 10 per cent. of albertite added and the same coal by by ordinary process with 5 per cent. of albertite, there is seen to be a gain in total economical effect of 77·63 per cent., showing the high value of the albertite coal when used only in small quantity in the hydrocarbon process. Were the value of the hydrocarbon process to be estimated by the increase of volume alone, the albertite is seen by column 8 to gain 93 per cent., while in the Peytona cannel the gain in volume is 124 per cent., and in the ratio of total economical effect is 24 per cent. To the manufacturer of gas, column 8 presents the results which are most likely to attract attention, as exhibiting the ratio of increase in the salable commodity.

In order to preserve the convenient term of comparison offered by the use of the same materials on a whether or not one or more of them are charged with anthracite in place of bituminous coal. It is in full proof that in the most economically constructed furnace, not over one-twentieth of the total calorific power of the fuel burned is applied to produce a useful effect.* It is plain, therefore, that there must be an important economy of fuel in setting the anthracite retorts in the same bench with the bituminous. We draw from these considerations the following very important practical conclusions, viz.:

Second.—The fuel cost for the mixed hydrogen and carbonic oxide from the anthracite retort would be the same as that for ordinary bituminous coal gas, *provided the volumes of the two gases produced by each retort were equal;* but inasmuch as the volume of gas from each anthracite retort is somewhat over 7,000 cubic feet for twenty four hours, while the gas from a like bituminous retort by the common process is not much over 4,000 cubic feet, it follows that the *fuel cost* for the water-gas is inversely as these numbers.* On the other hand, if the anthracite retorts were to to produce this volume of steam, a little more than two cubic feet of water must be evaporated. Taking eight pounds as the amount of water evaporated by a pound of coke, it follows that to evaporate 125 pounds of water (=2 cubic feet) will require about 16 pounds of fuel. Now, at Fair Haven, one of three retorts in a bench was an anthracite retort producing rather more than 7,000 cubic feet of water-gas daily, and the amount of coke required to produce it was therefore about 16 pounds.

Fifth.—The labor involved in the management of the hydrocarbon process will be found to be less than is connected with the manipulation of the same number of benches on the common plan. This statement will doubtless excite surprise on the part of some, but

* This estimate applies especially to steam boiler furnaces, but is measurably true of all furnaces.

* We are well aware that many gas engineers claim a yield of 25,000 cubic feet of 15 candle gas in 24 hours from a bench of five clay retorts. This is a fair estimate for a new bench, but if the proper deductions be made for the gradual decline of power due to the accumulation of carbon, and the consequent loss of time in the working of the bench, arising from the necessity of burning out the accumulated deposit of carbon, it will be found that 20,000 cubic feet of gas per day is a fair statement of the actual working results from a bench of five clay retorts with ordinary caking coals.

† In April this quantity was 6·11 lbs. only, due to greater care in working.

the following facts warrant the opinion here expressed:

Take for example a bench or bed of five clay retorts, each nine feet long, the four lower retorts 14 by 22 inches each, and the fifth and upper one 15 by 28. To adapt this bench to the hydrocarbon process, the two retorts of the middle tier are fitted for anthracite and steam; the two lower ones are capable of burning off six charges of 224 pounds (one-tenth ton each charge) daily, while the upper retort will receive 275 to 300 pounds of Peytona or some other cannel. Let us suppose the two anthracite retorts charged with 600 pounds of anthracite each, and, when fully heated—the whole bench being in the same condition—the two lower retorts receive their charges of 224 pounds each of, say, Westmoreland coal. The hydrogen is now turned from both the anthracite retorts for two hours, upon the distilling products of the two Westmoreland coal retorts; just before the expiration of this time, the upper retort receives its charge of cannel, and the hydrogen is turned off from the Westmoreland upon the cannel for two hours. This completes the four hours round on the Westmoreland retorts, which are drawn, recharged, and the hydrogen, cut off from the cannel, is again restored to the Westmoreland retorts, while the cannel retort is waiting to be drawn and recharged in its turn.

The manufacturing returns of this operation will be as follows, for 24 hours:

6 charges of Westmoreland (2 of 224 pounds each)	2688 lbs.
6 charges of cannel, say 275 lbs. each.	1650 "
Total weight of coals carbonized	4338 "
The Westmoreland alone, with the hydrogen, etc., produced 6·26 feet per lb. equal to	16,816 cu. ft.
The Peytona cannel produced by the hydrocarbon process 8 feet, equal to	13,200 " "
Gas produced from one bench	30,016 cu. ft.

The candle power of this mixture will be by our experiments, 14·68+20÷2=17·34 candles.

If Boghead cannel were to be used in the cannel retort, the product from 1650 lbs. would be about 25,000 feet per ton, say	18,900 cu. ft.
Giving a total product of	35,700 cu. ft.
And an average candle power of	20 c'd'les.

The coke from the Westmoreland coal is 40 bushels to the ton and gives to the bench 48 bushels.

Coke required to fire the bench	36 bushels.
	12 bushels.

The labor involved in this operation is as follows:

In any well-ordered gas-work on the ordinary plan, 4 men in the retort house (4 by day and 4 by night) will easily stoke 5 fires and take care of the charges.

In this operation two-fifths, or forty per cent., of the labor of handling coal and coke is saved. If Peytona cannel is used the coke will be salable for domestic use, but will not keep up the heats of the benches. If Boghead is used its coke is worthless.

The anthracite retorts are charged on Sunday, and require attention but once a day during the week. We opened them usually at 7 A. M. daily, raked back the coal, and added 70 to 90 pounds (see Tables in Appendix) of fresh coal. It is probable it would be a better practice to draw the anthracite charge twice in the week, say at 8 A. M. Sunday and 8 P. M. Wednesday; as it is observed that the water gas flows more freely when the charge is fresh. It is, however, important not to throw in the whole charge of anthracite *at once*, as 600 or 800 pounds of cold coal is a severe test of the retort, and it is but little trouble to divide the charge into two or three parts with a two hours interval. The coal should be dry. It will readily be seen that the labor connected with the anthracite retorts is quite trifling, as compared with the 5 or 6 daily charges and drawings of bituminous coal retorts.

This statement may be summed up as follows, for a series of five benches for 24 hours:

5 benches yield 20,016×5×	150,080 c. f. gas
Coal consumed 4338×5=	21,690 lbs. coal.
Giving coke=bushels 240	
Consuming coke=bushels 180	
Leaving surplus=bushels 60	
Labor required in the retort house for 24 hours	8 men.
Labor required in the yard	1 man.
Anthracite coal required, say	130 pounds.
Lime for purification, say,	40 bushels.
Administration and repairs	—

With these data the cost of the gas may be computed by each gas engineer for his own locality.

Nothing is said of the cost of steam. If it requires to be supplied by a boiler expressly heated for the purpose it will use 350 pounds, or say 9 to 10 bushels of coke. But it is assumed that in all works of any magnitude the steam will be furnished by the waste heat of the benches.

[To be continued.]

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Ed.

Burning Tar for Fuel.

Gas Works, Halifax, N. S.,
March 21, 1874.

Mr. Editor: I have read with considerable interest the numerous articles in your valuable Journal of late, headed as above, being in a position somewhat similar to that of Mr. Cathels, viz., of having had considerable experience in the use of tar as fuel (for I have been using it for the last twenty-nine years). These articles were all the more interesting, and I might also say amusing, because (to use a common expression) I have gone through the mill with the most of them long long ago. I may say that the grinding process described by one of your correspondents (Mr. Nettleton, I think), is among my earliest recollections of the attempt to use tar as fuel. This being over thirty years ago, in Scotland. After trying several methods, with partial success, about seventeen or eighteen years ago, I adopted the plan which I have continued ever since, with very little alteration, having found it to give entire satisfaction with scarcely any trouble, and very little expense, and which is simply as follows: When building the furnace to be used for tar, I build in the bearers for carrying the furnace bars, the same as if they were to be used for coke; all the other parts of the oven are built in the usual way except the front. In building up this I leave two openings on a level with the bottom of the furnace door, viz., one on each side of the furnace door frame. The size of these openings I generally make three inches deep (being the size of a brick) by two and a half inches wide. They are carried into the furnace immediately behind the frame of the furnace door. Then on the top of the arch, immediately over the furnace door, I build in a fire clay block nine inches by five inches by fourteen inches. This block projects three inches inside the brickwork, and is consequently twelve inches inside the furnace door. It also projects two inches outside the front. A small round cavity is made in the latter part of the block, about half inch deep, with a groove cut the whole length of the block, and being about one inch deep inside, which I find sufficient inclination to convey the tar into the furnace; the front above this point is carried up in the ordinary way.

I have a cistern fitted up outside the retort house, sufficiently elevated to give the necessary fall to the pipe for conveying the tar to the furnaces. This cistern is carefully covered so as to prevent any dust getting into it. An opening is made in the cover for the reception of a sieve made of very fine brass wire, having about 33 meshes to the inch. The outlet pipe from the cistern is raised about four inches from the bottom, and has a stop cock attached close to the cistern: from this it is carried along to the front of the retort bench, and bent down by the edge of the cast-iron bender between two ovens, and terminates in a small brass stop cock, with a hole in the key, of one-eighth inch diameter, this hole being quite sufficient to supply tar for two ovens.* Immediately underneath this stop cock, and secured to the cast-iron bender, is a short piece of three-quarter inch iron pipe drawn out at the points, and having a funnel in the centre (see engraving). This pipe is so secured that either of the ends can be elevated, so as to cause all the tar entering it to run out at one end only, when required for supplying one furnace; but it two furnaces are required, then it is set level, and so adjusted, that an equal stream shall flow from both ends, from the points of the pipe. The tar is conveyed in a separate piece of one inch iron pipe to the fire clay block with the groove in it, where it runs into the furnace.

Before turning on the tar I fill up the ash pit with fine ashes, to within six inches of the level of the bottom of the furnace door, then lay two courses of fire brick well bedded in fire clay, giving them a descent of five or six inches towards the back end of the furnace. This being done, and having filled the cistern with tar through the wire sieve, nothing is required but to put some live coke into the furnace and turn on the tar. It takes longer time to heat up a bench of retorts with tar than with either coke or coal: but instead of considering that any loss, I believe the reverse is the case, for every thing gets more time to dry thoroughly and is exposed more gradually. Neither do I turn on the full stream required, until the retorts are nearly hot enough for charging; then the stream is increased, and from that time there is no black smoke ever seen issuing from our chimney from these furnaces. It will be observed from the foregoing description, that all the air that goes into this furnace must go in through the two small openings behind the door frames, except the small quantity that passes in with the tar; so that when the heat is once raised sufficiently high for constant working, and the draught increased by opening the damper, the operation is something like a blow-pipe on a large scale, and I have never experienced the difficulty complained of by Mr. Cathels, with the horse heads. If properly regulated the tar is so thoroughly consumed that the residue (which is very little indeed) is drawn from the furnace more like sand than anything else. Of course we always try to keep a large piece in the center of the furnace for the tar to fall on. I find the quantity of tar necessary for keeping up the heat on three large D retorts, so that they will work off their six charges in 24 hours is about 50 gallons; and instead of having any difficulty in keeping up the heat with the tar alone, I think I could almost compete with Mr. Walker of Milwaukee, in the *melting down* process, even allowing him the assistance of steam.

In spring, when we have a demand for tar, and it is cheaper to use coke, all that is required to alter my furnace so as to burn coke is simply to dig out the ashes from the ash pits, take out the two course of fire brick, put in the furnace bars, and fire away. All this can be done by the firemen in less than half an hour.

I hope I have made this description clear enough, so that any of the fraternity can try it for themselves; and if done as described they will find the results all that I have stated. Yours respectfully,

George Buist.

* I generally keep two ovens going with tar from about the end of November till the end of February, and the other for about three months longer. This consumes all the tar for which we have no demand in the winter season. I have found the round hole in the key of the stop cock does not stop the flow of tar so readily as when they are made long and narrow, and therefore prefer this kind.

Mississippi Sediment.—The results of the efforts of the Water Commissioners in St. Louis to improve the water of the Mississippi, for the sake of the consumers in that city, are shown in their report for 1879. During 1873 the low-service engines pumped from the river into the settling reservoirs or basins, as they are technically called, 6,081,800,000 gallons of water. During the same time the high-pressure engines pumped from these basins into the reservoir at Compton Hill, and into the city, 5,981,740,000 gallons. The difference, 100,000,000, was used in cleaning the basins. They were cleaned out once a week, and the sediment removed during the year equaled 116,000 cubic yards, or 156,000 tons. The cost of removing this sediment was two and a quarter cents per cubic yard, or $2,610 total. The cost of clearing the basins amounted to 58 cents for every 1,000,000 gallons, equal to 25,000 barrels of water pumped into the city. If the sediment had all been deposited in one basin (690 by 270 feet surface) it would have filled it to the depth of 19.3 feet.—*Eng. and Min'g Jour.*

Economy of Fuel.

[From "Engineering."]

The *Revue Universelle des Mines* some little time ago published a series of valuable papers on the subject of the "Economization of Fuel," from the pen of M. Paul Charpentier, in which the author strongly insists upon the advantage of using fuel of every description in a gaseous state and under a constant pressure.

His arguments in support of this may be briefly stated as follows:

That combustion—employing the word in its ordinary industrial acceptation—may be what is termed perfect or complete, it is essential that the following conditions be satisfied:

1. The combustible and the supporter of combustion must be intimately intermixed.

2. These bodies must be in the same physical state, in which case alone the first-named condition is attainable.

3. They must be brought into contact at the temperature best suited to their complete combustion.

4. With a like object a sufficient surface must be given to the flame.

5. The relative proportions of the combustible and the supporters of combustion must be exactly those requisite to complete combustion.

These conditions, M. Charpentier asserts, can be best satisfied by a system proposed by him, which is stated to be applicable to fireplaces of every class and description. The remarks in the *Revue* apply chiefly to the furnaces employed in industrial processes and for locomotive purposes.

To show the defects of the methods now in use, M. Charpentier institutes a comparison between the theoretical and the actual calorific power of ordinary ceal.

Taking a coal of the following composition:

	Kilog.
Pure carbon	65
Ash	5
Hygroscopic water	5
Tar	5
Illuminating gas	20
	100

he shows that according to the calculations of MM. Favre and Silbermann, and of M. Regnault, and assuming the whole of the heat to be utilized, we have 8·038 calories per kilogramme as the calorific power of the coal. Each kilog. of this coal would, accordingly, evaporate 12.618 kilog. of steam at a pressure of one atmosphere. This is the calorific power in theory. In practice he asserts that the result is about 3 kilog. of steam for each kilog. of coal burned.

The causes of the waste of heat—and consequently of fuel—herein implied in the furnace of ordinary steam boilers he shows as follows:

1. Loss of heat occasioned by the pressure of atmospheric air in greater volume than is requisite to perfect combustion.

2. Loss of heat through the chimney.

3. Loss of heat by smoke.

4. Loss of heat by cinders.

5. Loss of heat in the evaporation of the 48 kilog. of hygroscopic water contained in every 100 kilog. of coal of the above description.

6. Loss of heat by radiation from the under surface of the fire-bars and other portions of the furnace.

In regard of the first, grouping the combustible constituents of the coal aforesaid, we have:

	Kilog.
Carbon total	82.39
Hydrogen total	4.73
Sulphur total	0.188
	87.308

The total volume of oxygen requisite to convert the above into CO^2, HO, and SO^2, would be 257.7 kllog. Reducing this by the proportion of oxygen contained in the illuminating gas, we have still 256.28 kilog. of oxygen required, which supposes the presence of 1,114.30 kilog. of atmospheric air occupying a space of 861.7 cubic metres at a temperature of 0 deg. Cent.

But the presence of the fire-bars will not allow us to give the amount of air thus required in theory. The bars impede the free contact of the air with the fuel, and to feed the fire it is found necessary in practice to increase the size of the air passage and the velocity of the draught. Most writers recommend a constant supply of air of double the volume requisite in theory. And even then combustion is very incomplete. The temperature of the gaseous products and of the heated air on entering the chimney varies greatly: but in all cases the loss of heat thus occasioned is very considerable; in certain industrial processes, as puddling, etc., and in locomotives driven at express speed, the loss is enormous. As a very reduced average M. Charpentier assumes the waste of heat thus caused at 16 per cent. of the whole. Again, as regards the chimney itself. Some writers content themselves with the assertion that the chimney carries off in waste 25 per cent. of the heat produced by the fuel. And this assertion will admit of rigorous demonstration. Employing the foregoing data, and assuming the temperature of the gases on entering the chimney to be 500 deg. Cent., it can be proved that a loss of 18 per cent. is incurred, without taking account of the specific heat of the gases which are thus allowed unlimited expansion, or of the imperfect manner in which combustion is accomplished, or of the heat carried off by the carburets of oxygen and hydrogen contained in the smoke, whose capacities for heat far exceed that of atmospheric air.

It may, therefore, be concluded that it is of great importance to deprive the gaseous products of combustion of their heat before they enter the chimney, as well as to avoid the influx of atmospheric air in greater volume than is absolutely necessary to complete combustion.

Again, in the matter of smoke. The great smoke question, M. Charpentier observes, has formed for many years the theme of animated discussion. Many inventions have appeared, but none, as yet, have satisfactorily achieved the desired end. This has arisen from the fact that the inventors have confined themselves to a narrow, one-sided view of the matter. Many persons regard the subject—sanitary considerations apart—as of trifling moment; others have attached an exaggerated degree of importance to the consumption of the smoke, but without recognizing its bearings on the question of economy of fuel.

Five conditions have been enumerated above as essential to perfect combustion. Practically, very few of these conditions are satisfied by the arrangements now in use. The combustible—the coal—and the supporter of combustion—the oxygen in the air—cannot be brought into the requisite state of intermixture, as their physical states are dissimilar. Conditions 3 and 4 are satisfied at best by haphazard. Locomotive engines are particularly badly arranged in this respect: combustion in them is, accordingly, very incomplete, and their chimneys belch out clouds of the densest smoke*

Now, the disadvantages of smoke are twofold: 1. It is insalubrious and a public nuisance. 2. It occasions a waste of fuel, and consequently of money, which in some cases is enormous, as few persons who have observed iron works, coke ovens, glass works, etc., pouring forth their sooty clouds, will be prepared to question.

But, smoke may be colorless, and yet carry off in waste the gaseous products of combustion to a very considerable extent. Many analyses have been attempted to determine the amount of unutilized gases contained in smoke. The mean of M. Debette's experiments showed a loss of 9 per cent. from this cause, but the first of these experiments indicated a loss of 24 per cent. Some experiments made in Alsace gave a mean loss of 15 per cent; Ebelmen only got 7 per cent.; M. Ser, in a chimney at Thierry, got 40 per cent. These experiments, it should be said, were made with the furnaces of steam boilers. In many departments of manufacturing industry, the loss is far greater; and we shall be within the mark if we take the average under all circumstances at 20 per cent. The loss of heating power by the formation of cinders is often very great, and is also very variable. In locomotives, notwithstanding the narrow openings between the bars, it is of some consequence, as the cinders are not turned to useful account. In certain metallurgical processes, the loss is very great indeed; the fires are constantly stirred, and the imperfectly burned coals fall through into the ash-pit to increase the intense heat which radiates therefrom. In the experiments of MM. Tresca and Silbermann, at Cherbourg, the loss of heating power, owing to the formation of cinders, was found to be 25 per cent. of the total heat produced. M. Charpentier considers that we shall be well within the mark if we take the average at 15 per cent. The waste of heat occasioned by the evaporation of the water contained in the coal and of that produced in the combustion of the hydrogen may be taken as 3 per cent. of the whole. The losses through radiation and the formation of clinkers are smaller and very variable in their amounts.

The total waste of heating power, therefore, stands thus:

	per cent.
Loss of heat occasioned by the presence of an excess of atmospheric air	16
ditto through the chimney	18
ditto by smoke	20
ditto by cinders	15
ditto by evaporation of water in the coal	3.6
ditto by radiation, etc	variable
	72.6

Say, 73 per cent. as the waste of an ordinary open furnace with natural draught. This is only a general average. In very many cases it is far exceeded.

Applying the foregoing to steam furnaces, we find that in place of twelve kilogrammes, the theoretical amount, only 3.3 kilogrammes of steam are evaporated by each kilogramme of coal; this, be it observed, hardly conveys a correct notion of the actual results, as a good deal of water is often carried off by the steam, thus increasing the weight of the latter. So much for the defects of the arrangements now in use. The waste of fuel thus occasioned, M. Charpentier proposes to reduce by suppressing the chimney altogether, and by consuming the fuel in a gaseous state and under a constant pressure, so that the variations in volume—and consequently in capacity for heat—which are now experienced by the gaseous products of combustion, may be avoided. He notices the various projects for economizing fuel, which have hitherto appeared, under four heads:

1. Revolving grates.

2. Supplementary appliances for the introduction of hot or cold air.

3. So-called "smoke-consuming furnaces," in which steam is injected upon the flame, upon the fuel, or into the chimney.

4. "Gas-stoves," so called.

The more or less complicated arrangements under the first head have been pretty generally abandoned. Those under the second are very nearly useless. It is not, generally speaking, that the air is present in insufficient volume—on the contrary, it is usually in excess—but that it is impossible to give it the requisite degree of intermixture with the incandescent fuel. The additional volume of air introduced tends rather to exaggerate than to diminish the loss of heating power. Those under the third heading are better adapted to the end sought, but the injected steam absorbs heat in decomposing, it increases the loss through the chimney, and costs dear for results that are practically small. The "Thierry" furnace, which is about the best, effects a saving of 10 per cent. but, it is admitted in the inventor's prospectus, that this saving is achieved at an expenditure of 8 per cent. of steam.

Lastly, we have the so-called "gas stoves." The principle of a preliminary reduction to a gaseous state of the fuel is an old one. Its first practical application in France was by MM. Laurens and Ebelmen. Since the researches of the latter, it may be said that no advance has been made, although the question has reappeared in sundry forms.

The most successful recent attempt has been that of M. Siemens. The loss of heat in the case of this gentleman's apparatus is estimated by M. Charpentier at 50 per cent., showing a saving of 20 per cent. over the arrangements in ordinary use.

After a lengthy discussion of the theoretical principles of heating with gas under a constant pressure, M. Charpentier proceeds to describe an apparatus, by which he thinks it is demonstrable that enormous advantages might be realized. He proposes to adapt it to fireplaces of every class. It consists of three distinct parts: 1. A gas generator or gazogene, in which the fuel is brought into a gaseous state. 2. A burner, in which the gas produced in the gazogene is burned. 3. An hydraulic regenerator. The gazogene is of ordinary design, and is supplied with condensed air by some sort of fanner: steam is also injected on the incandescent fuel.

The burner is in the form of a pipe placed in any position required, and connected by a valve with the gazogene. It is so arranged that the burning gases are surrounded by air, which impinges on them at an angle, that can be varied according to circumstances, and to the length of flame required.

The hydraulic regenerator receives from the burner the gaseous *residue* of combustion, and secures the following results:

1. The almost perfect utilization of the sensible heat carried off by these gases, which sensible heat has hitherto been employed only in maintaining the wasteful draught of the chimney, It may be observed, that the necessity of having a draught to assist in the reduction of the fuel is obviated by the employment of condensed air, by which, it is calculated, a saving of 25 per cent. will be effected.

2. The utilization of the heat rendered latent by the evaporation of the water existing in the fuel, and

* M. Charpentier's experience with locomotives appears to have been of an unusually unsatisfactory kind.—ED. E.

of the water produced by the combustion of the hydrogen in the latter, which latent heat is transformed into sensible heat available for useful application.

3. The economization of the heat hitherto wasted by the unlimited expansion of the gases. The maintenance of a constant pressure prevents any portion of it becoming latent, and thus not practically available.

4. It assists in securing complete consumption of smoke.

5. The water in the regenerator being almost always employed to feed the steam boilers, and being at a temperature of about 100 deg. Cent., the excess of carbonic acid which it contains, becomes quickly separated therefrom, and the calcareous matters held by it in solution in virtue of such excess are deposited in the regenerator, thus securing the boiler against incrustation.

The advantages claimed for his system by M. Charpentier are the following:

1. It may be used with any sort of fuel.

2. It will give greater durability to metallurgical furnaces by getting rid of the excess of oxygen, the chief cause of destructive oxidization.

3. The nature and intensity of the flame may be regulated at will.

4. It may fairly be expected to give not only increased economy but improved results, in iron and steel manufacture.

5. In marine boilers the saving in fuel effected will enable a smaller supply to be carried, thus giving increased capacity for accommodation or stowage.

6. It gives a higher temperature than any method yet devised.

7. The boilers are saved from incrustation, and the chances of an explosion are thus reduced.

8. The suppression of the smoke is complete. In addition to these direct and indirect advantages we find a total absence of cinders.

Appended to M. Charpentier's memoir is a *procès-verbal* of some experiments made with his apparatus on the Orleans and Rouen Railway, in the month of September, 1872. The results are stated to have been very satisfactory. The saving of fuel in the locomotive employed amounted to 47 per cent., and in one case to 66 per cent. These results, however, appear to us to require confirmation, and M. Charpentier seems throughout his memoir to have exaggerated losses, and to have considerably underrated the results obtainable by other plans than his own.

The City Companies at Loggerheads.

In answer to the advertisement for proposals for lighting the city the four old companies put in bids, each to light the portions of the city they were then lighting, and the Mutual Gas-Light Company to supply the lamps where their mains ran. In the other districts the old companies underbid them; but in the portion of the city extending fram Thirty-fourth to Seventy-ninth street, wh ch the Metropolitan Gas Company had been supplying, the Mutual Company's bid, being the lowest, was accepted. They, however, inserted in their bid that they should have reasonable time to make connections. Though the contract was to run from January 1, the awards were not made till January 24, and immediately thereafter, Oscar Zollicoffer, not as President of the Metropolitan Company, but as a tax-payer, interested to prevent waste of the city property, brought action to prevent the mayor and the other members of the awarding Board, the city, and the Mutual Gas Light Company from executing the contract. The ground on which a temporary injunction was granted and a permanent one asked was that the bid of the Mutual Gas-Light Com pany was so irregular as to give no security for its execution to the city. Judge Donohue, in Supreme Court, Chambers, was appealed to yesterday for a permanent injunction, and reserved his decision.—*New York World, April* 1.

Sulphur in Gas.—The "sulphur question" has been brought up in Coventry in a way that will probably lead to a renewed investigation into the consequences of the presence of sulphur compounds in gas. It has always been alleged that one result is damage to delicate colors on textile fabrics, and this is just the complaint made by a leading silk dyer and ribbon manufacturer in Coventry, who alleges that his fine shades of red become spotted when the ribbon is woven in a factory where a large quantity of gas is consumed.—*London Journal of Gas-Lighting.*

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Publishing Office, No. 42 Pine Street.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

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EDITOR---PROF. HENRY WURTZ.
Editor's Private Office, 12 Hudson Terrace, Hoboken, N. J.
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THURSDAY, APRIL 16, 1874.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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CORPSE-LIGHTS.

Although—or perhaps, because—the topic is of late being so bewritten, cremation*ism*, as we may call it, has, for four years past, been treated by us with entire neglect. Though just now a first-class newspaper sensation, doubtless very delightful to those who have a *gust* for it (and not a disgust)—for we are told in familiar Latin that about gusts there is no disputability—still this would not be a reason for according to it space, were it not that this "ism" has again and again—in its wild search throughout the heavens and the earth, and the waters under the earth, for support—invaded the realms of gas-lighting; of which we, however unworthily, are the only champion on this continent.

Indeed, the subject of cremation is one which at present—and, we think, in the future also—does not properly belong to Science (as we understand the word), or to the Arts, at least in civilized countries. As a matter of speculation in "Social Science," so called, reside its only claims (and these but *in posse*) to discussion in the columns of a scientific or technical journal. The chemical and sanitary arguments, which have been so much relied on, have far too little *real* force to furnish a sufficient basis for so stupendous a revolution—social, legal, moral, and it may be with many, religious—as would be the universal practice of cremation. Into this we cannot enter now, but will do so on another occasion, should it appear desirable to use our space in combatting the delusions that are being so popularly and rapidly disseminated in the public prints, on this subject.

It is only, however, where the advocates of cremation trench upon our prerogatives, in proposing and urging such gross absurdities as the conversion of our gas-houses into charnel places, that we can now undertake to meet them. This strange delusion has been carried so far, and men have become so infatuated with the idea that their cast-off relics of humanity, from which the light of life has fled, can yet be made useful to their race, in furnishing illuminating gas—that men, presumably of education and intelligence, are making wills, handing over as precious legacies to Gas Companies, what the latter doubtless no more would or could touch or receive, for the designated purpose, than the contents of a cesspool.

That we may not be deemed to exaggerate, it is our painful necessity to cite a case in point, which seems incredible. A contemporary, the *Manufacturer and Builder* (April, 1874), tells us that "one of the wealthiest persons in New York," after considering the suggestion, stated to have emanated from that Journal, that "the most useful thing" to do with dead bodies is to make gas of them first and manure of them afterwards—has put it into his will, that his remains shall be injected "with petroleum, cresylic alcohol, or its disinfecting equivalents, be laid in a metallic (iron) coffin, as small as practicable, and a burial service held * * * Immediately after the close of said services, the hearse, conveying the coffin with my remains, shall proceed to the Manhattan Gas Works, where the lid shall be removed, and with due solemnity be placed in one of the retorts, and the same closed for the space of three or four hours, the usual heat applied, so that all the moisture and gaseous ingredients may be driven off, partially condensed, passed through the purifiers, while the nitrogenized compounds will be collected as ammonia as usual, and the hydrocarbons add their share to the duty of illuminating the city.

"The retort shall then be opened so as to admit air to the heated matter, in order to burn as much as possible of the carbon remaining into carbonic acid escaping. If any respectable party or association expresses a desire to preserve my ashes, they shall be placed in an urn, or other substantial vessel, and delivered to the same. If no such desire is expressed, I direct that my ashes shall be delivered to the Central Park Commissioners, to be used as fertilizing material on one of the flower beds near the music stand, in the Central Park."

According to the letter of the above, only the (iron) lid of the coffin is to be converted into gas, but the whole thing has too serious an aspect to admit of any suspicion of a latent jest. Executors are named, to see the thing done.

Now this might all pass, with the more charitable, for mere melancholy madness; but the most astonishing part of the tale is yet to be told. The distinguished Editor of the Journal from which we quote—a gentleman universally regarded with respect, we might even say veneration, for his intellectual attainments, appends to this the following:

"We are happy to record such an example of enlightenment, for the truth of which we are personally responsible."

Further quotations for which we have not room, would only make this business the more surprising.

We are sure, that our contemporary, on due consideration, will withdraw the high sanction he has given to *this* phase of the cremation mania. The cremationists themselves are distinctly aware of the difficulties of burning a dead body on a funeral pyre, and of the great mass of fuel required. A corpse, even an emaciated one, contains at least 70 per cent. of water—that is, for a medium-sized man, near 100 lbs., or over twelve gallons of water. Now, we ask any man of common sense, not to say a gas-expert, or our learned *confrere*, what would be the effect of putting into the hottest gas retort a charge containing 12 gallons of water? Could the heat remain at the gas-making point for five minutes? Again, deducting from the (30 per cent., say) of solid carbonaceous matter in a cadaver, the earthy matter of the bones, how many pounds of solid dry gas-yielding matter would there be left? We presume that 18 lbs. would be a fair average estimate. It is plain that a *Gas-Charnel* would be a poor affair for its stockholders, so far as dividends from the gas are concerned. No such mode of "throwing cold water" on gas enterprises will "go down."

We presume the disciples of the new "ism" will not go so far as to claim that gas companies should abandon their works, for cremation purposes, *pro bono publico*; and it seems highly improbable that any competing works will anywhere be started, for the special purpose of distilling our dead relatives. Will not our cremationist friends please confine themselves hereafter, therefore–in their last wills and testaments—to the furnace and the fagot? The proposed kindness to gas companies, we are sure, will be ill appreciated by the producer, and worse appreciated by the *consumer*.

A SAD MISTAKE.

In our account in the last issue of the Massachusetts Institute of Technology, we were led astray, by incorrect information; so as to speak of Professor Wm. B. Rogers, of Boston, as deceased. Our informant must have confused this gentleman with his brother, Professor Henry D. Rogers, of illustrious memory, who has been some years dead.

BOGUS BUTTER.

A few years since, as we all remember, King Shoddy, one of the popular potentates of this Age—and peculiarly of this people—was kind enough to send us a lovely recipe for making a pound of (sham) butter out of a pint of milk. This kind of butter, however, did not long "rule the roast," as it was not found to deceive any other sense except that of the eye. The "proof of the pudding" was not favorable in result.

The siege of Paris gave the old rascal another chance, in the butter line of business; and, with his long, gleeful and profitable experience of the "fatal facility" of Americans, almost convincing us that they, at least, realize the supposition that—

"The pleasure is as great
In being cheated, as to cheat—"

this king of shreds and patches quickly dispatched his ministers to us with his new invention—which, after all, even possesses only sham novelty.

To speak with entire seriousness, we protest—in the name of science, of civilization, and of decency—against these impositions, in which this age is so fertile; some foolish, some nauseous, and some dangerous (like shoddy kerosene, for example): and we trust that time may soon bring us laws which will enforce the labeling of foods, garbage, poisons, and explosives, exposed for public sale, with their real names; so that we may get *our* butter from its native cow, and thank God for his good gift—and if we *should* adopt the vagary of eating "oleo-margarine" instead, or even any other kind of grease, we may be enabled to buy *it*, and be sure of it. Fat-rendering is, in its way and place, a high art, no doubt; but we want our butter to be derived from cream, and not from cremation, or anything approaching thereto.

PRICES OF COALS: FROM HEAD-QUARTERS.

On this page will be found what will be highly acceptable to our readers—the Trade-Circular, with Price-Lists, of W. H. Waterbury & Co.; which will be hereafter continued and modified, as these gentlemen dictate. Among the coals of this firm is found the New York and Cleveland Gas-Coal Company's celebrated Youghiogheny Gas Coal, so long and so favorably known in the western markets; and now, this year for the first time, reaching our eastern and seaboard markets, through shipments *via* South Amboy, N. J., through their sole agents, Messrs. Waterbury & Co. The mode of preparation and selection of this coal for the use of Gas Companies is special, as they occupy the special vantage-ground of having a separate sale for their smalls and slack, in Pittsburgh; so that they ship to eastern markets the *lump only*.

The Editor of this Journal has now, approaching completion, a thorough chemical analytical investigation of this Youghiogheny coal and its gas; the results of which are altogether in accordance with its reputation. These results will appear in our next issue.

DR. HAYES ON CANNELITE, AGAIN.

In a recent issue we entered the complaint that, through inadvertence on the part of a contemporary, the *Coal and Iron Record*, the authorship of the above contribution from Dr. Hayes to our columns, was transferred to the Editor of this Journal. That the importance we attached to the occurrence was not out of place, is now shown by the fact that another Journal, the London *Journal of Gaslighting* (issue of March 17) has copied it, not directly from us, but apparently from the *Coal and Iron Record*, or elsewhere, with all it erroneous statements of authorship; and in the London journal it stands as quoted from the AMERICAN GAS-LIGHT JOURNAL! It never rains but it pours.

CIRCULAR No. 2, 1874.

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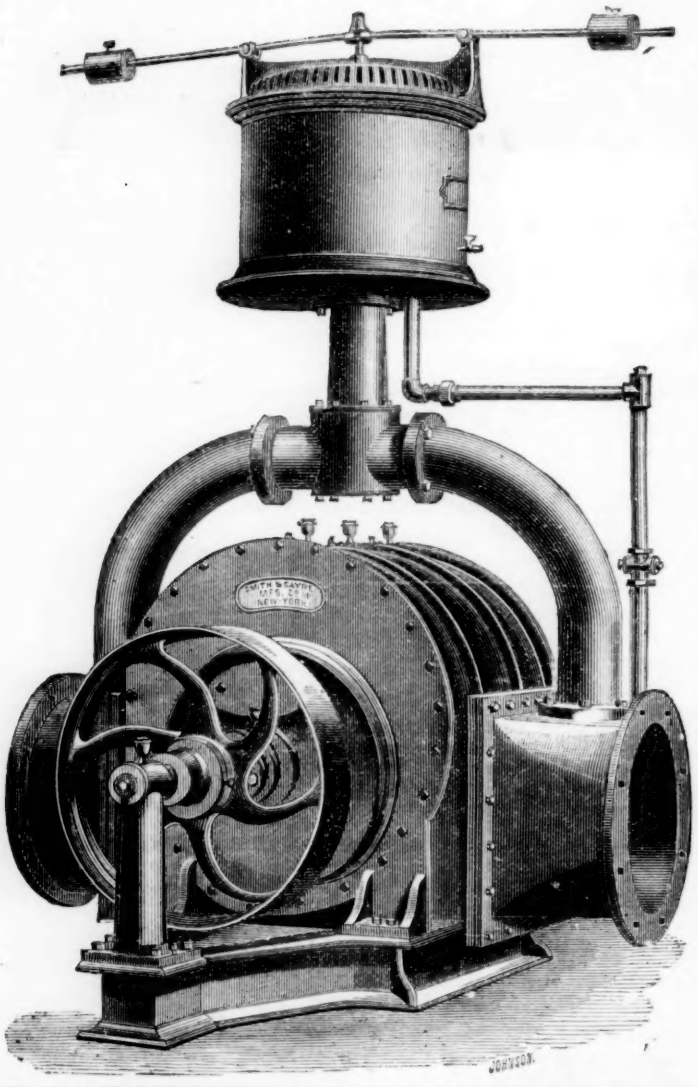

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

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CHARLES W. ISRELL, Secretary.

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The Screen is made with an oak frame, interlaced with split rattan, drawn through holes at regular intervals in the Frame and cross-pieces, the edges of the frame being grooved prevent abrasion.

The advantages of the screen are:

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2d. On account of the free passage of the gas through the creen the pressure is reduced, thereby preventing the accumulating of carbon on the retorts.

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Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any her now used.

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The pressure thrown upon the retorts by contracted passages is very great, and were gauges used more frequently than they now are in many gas-works, this facat of having *open Trays* would become more apparent to mangers of gas works. The digerence in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

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Respectfully yonrs,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years, and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respedtfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3, 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.
SPRINGFIELD, MASS., Oct. 10, 1871.

MR. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable. and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty pet cent. more gas with them than with any other Screen we have used.

Yours respectfully,
THOMAS J. FISHOU

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO., HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give yau my experience.

Yours truly,
P. E. DEMILL, Secretary.

We give a list of some Gas-Light Companies using them.

Providence, R. I. Gas-Light Co., Boston, Mass. Gas-Light Co.: East Boston, Mass., Gas-Light Co.; South Boston, Mass. Gas-Light Co.; Springfield, Mass., Gas-Light Co.; New Bedford, Mass., Gas-Light Co.; Manchester, N. H., Gas-Light Co.; Reading, Penn., Gas-Light Co.; Biddeford, Me., Gas-Light Co.; Hartford, Conn., Gas-Light Co.: New Haven, Conn., Gas-Light Co.; New Orleans, La., Gas-Light Co.; Savannah, Ga., Gas-Light Co.; Charleston, S. C., Gas-Light Co.; Trenton, N. J., Gas-Light Co.; Charlestown, Mass., Gas-Light Co.; Dorchester, Mass., Gas-Light Co.; Chelsea, Mass., Gas-Light Co.; Baltimore, Md., Gas-Light Co.; Manhattan, N. Y., Gas-Light Co.; Cincinnati, Ohio.; Gas-Light Co.: San Francisco, Cal., Gas-Light Co.: Albany, N. Y., Gas-Light Co.; Sacramento, Cal.; St. Joseph, Mo., Gas-Light Co.; Leavenworth, Kansas, Gas-Light Co.; Macon, Ga., Gas-Light Co.; Roxbury, Mass., Gas-Light Co.; Lansinghburg, N. Y., Gas-Light Co.; Bridgeport, Conn., Gas-Light Co.; Stamford, Conn., Gas-Light Co.; Poughkeepsie, N. Y., Gas-Light Co; Scranton, Penn., Gas-Light Co.; Lewiston, Me., Gas-Light Co., and one hundred others.

Address **R. A. POTTER, Treas.,**
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EDWARD DUFFEE, Agent.

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Patent Conically and Diamond Slotted Solid Wood Trays.

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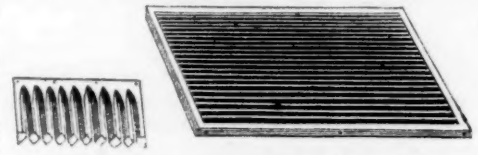

To Gas Companies.

The above Trays will last longer. and are cheaper than any Tray now used. They are now made without any outside strips, which gives more purifying surface, being perfectly smooth. The lime will not adhere to them as in other Trays. They are now used in over three hundred Gas Companies in the United States, and other places.

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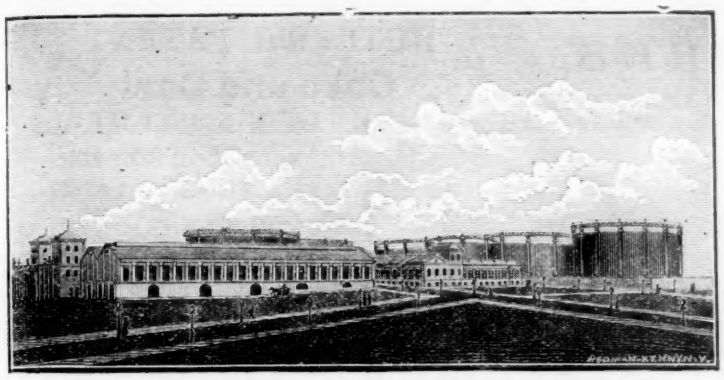
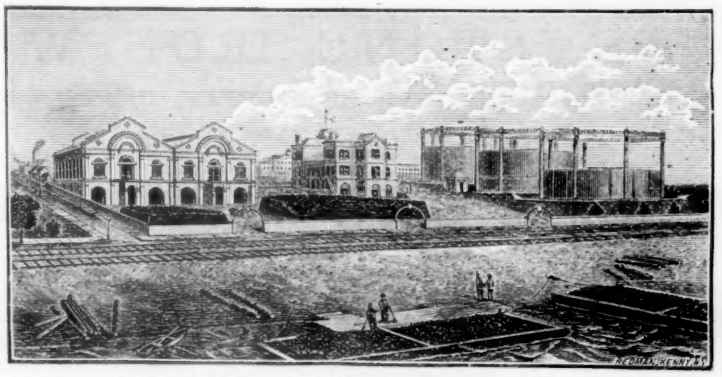


CINCINNATI GAS WORKS, ERECTED 1871-72-73.—WM. FARMER, ENG.



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Exhausters for Gas and Foul Lime Ventilation,
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Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500; $250 additional for each additional 50,000 per day.

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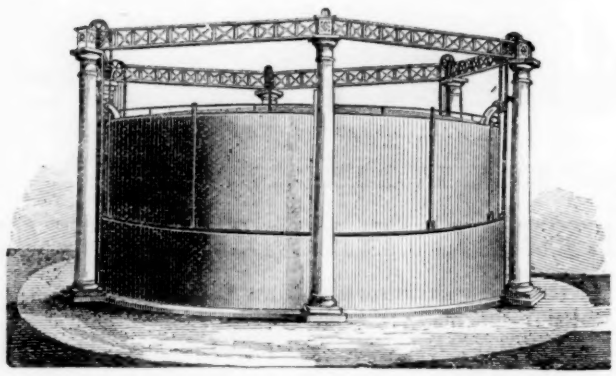

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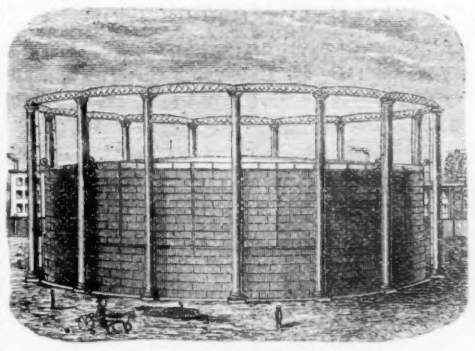

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It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

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The best dry coals shipped, and the promptest attention given to orders. 224-1y.

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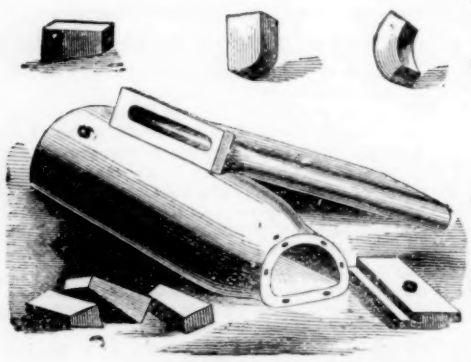

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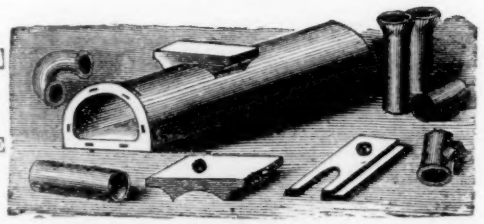

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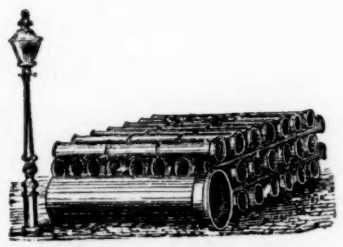

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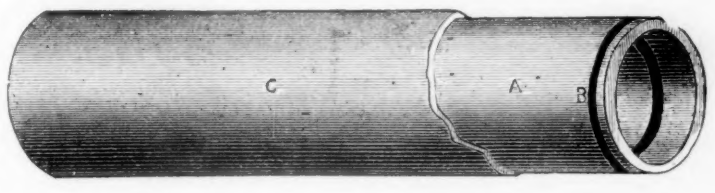

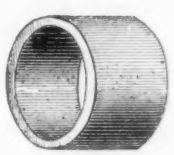

FIG. 2.

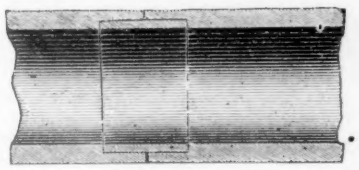

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cemen

FIG. 2.—Thimble for Connection. FIG. 3—Horizontal Section and Connection.

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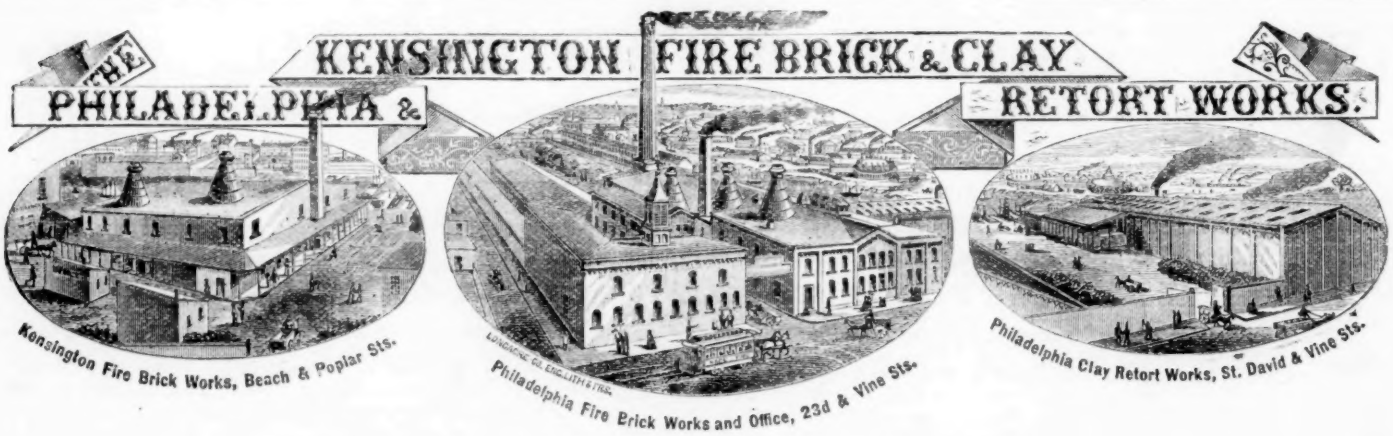
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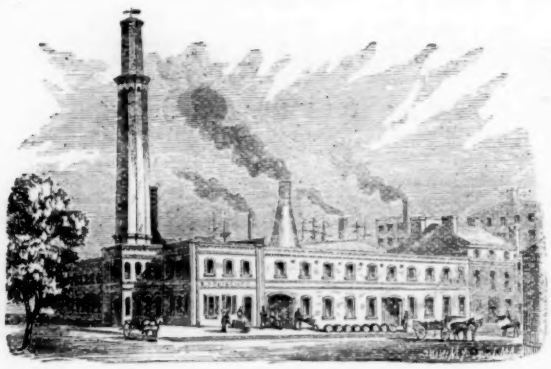

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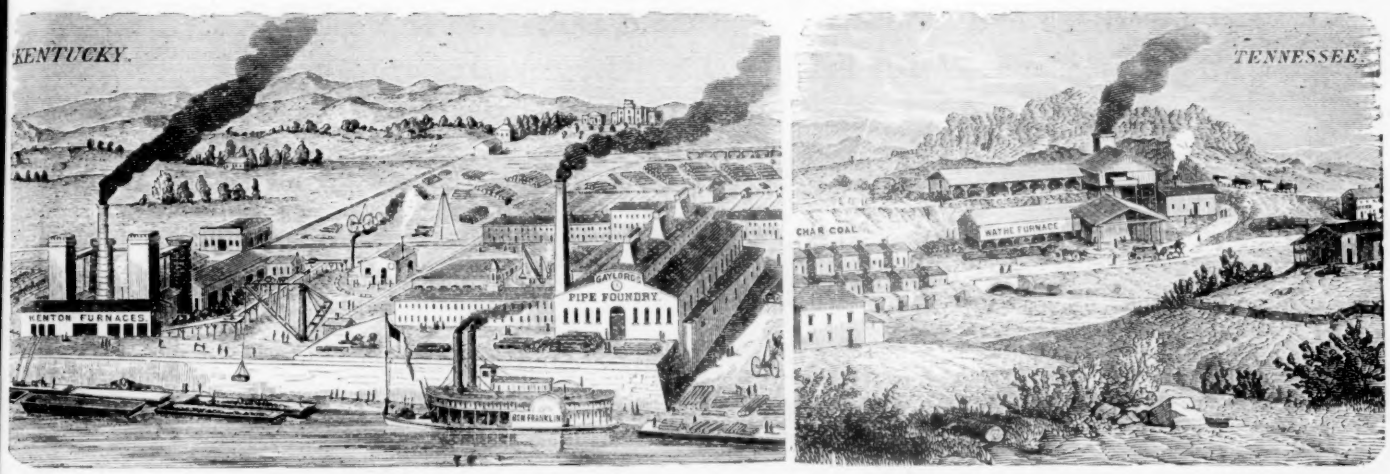

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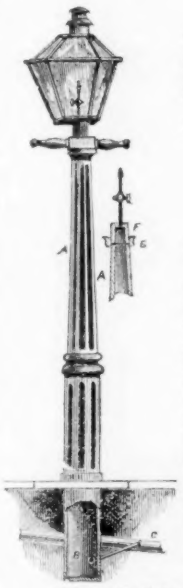

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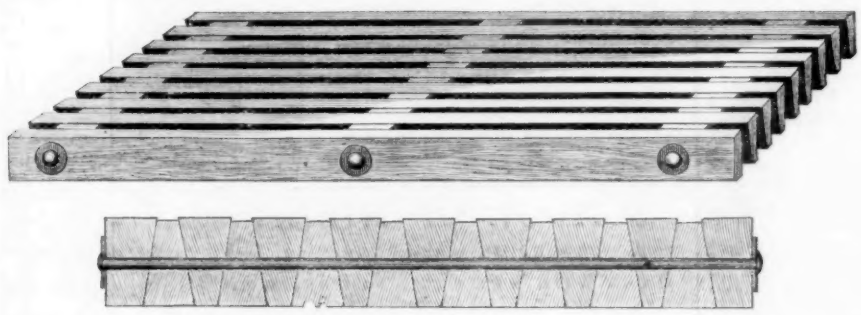
GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

P. Munzinger's Patent Ash Lime Trays.



In use at the following Gas-Light Companies:

Pittsburg Gas Company, Pa.
Peoples Gas Company, Baltimore.
Lowell Gas-Light Company, Mass.
Lynn Gas-Light Company, Mass.
Albany Gas-Light Company, N. Y.
Schenectady Gas Light Company, N. Y.
Utica Gas-Light Comwany, N. Y.
Jersey City Gas Company, N J.
St. Paul Gas-Light Company, Minn.
Cumberland Gas-Light Company, Md.
Hartford City Gas-Light Company, Conn.
Richmond Gas Company, Va.
McKeesport Gas Company, Pa.
Middletown Gas Company, Pa.
East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. J.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas.
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich
And numerous other Companies.

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